

They can be caught conveniently in a gill-net, but with great difficulty in a seine.

My pond covers 5 acres of land, the largest and best pond in Western Georgia. It is a perfect mass of fish and has been constructed only eleven months. The water is from an inch to 5 feet deep, and abounds in vegetation. I could sell it for a fine price, but I would not exchange for the best four-horse farm in Georgia. The twenty little carp you sent me last winter, then about 3 or 4 inches long, are now 20 inches in length. I had two old ones that I bought, and they have stocked my pond with hundreds now about 8 or 10 inches long.

HOGANSVILLE, GA., *October 31, 1883.*

I am anxious to send you some of my "speckled cat," and to have you test their value as a domestic fish in the Government ponds. I can send you some alive without danger.

I am sending the September spawn all over the Southern States now, and when they are properly introduced they will give the laborers or farmers all the meat needed.

HOGANSVILLE, GA., *November 5, 1883.*

#### 164.—THE MIGRATIONS OF THE SALMON (*SALMO SALAR L.*) IN THE BALTIC.\*

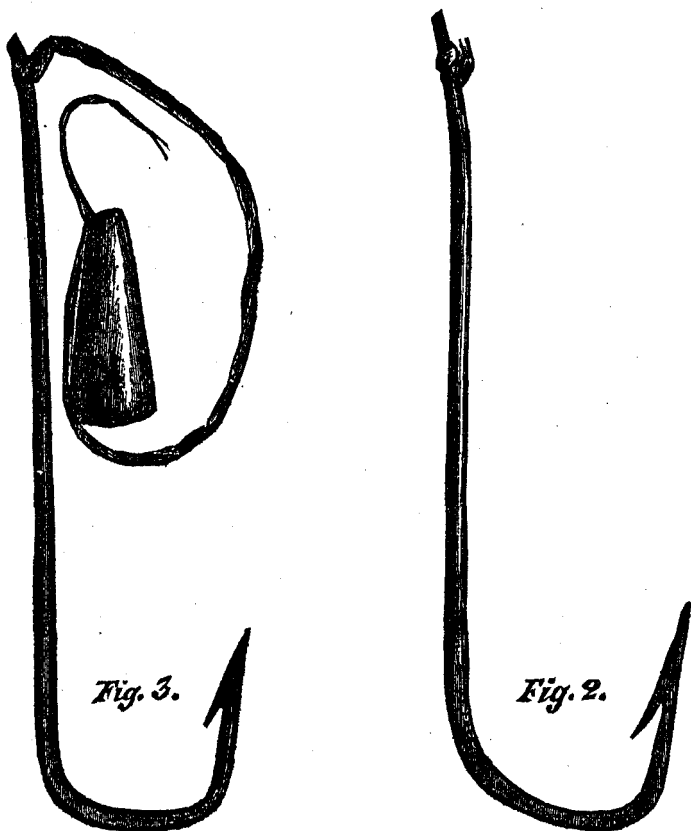
By Prof. A. J. MALMGREN.

From time immemorial there have been caught in Finland salmon in whose mouth or entrails have been found hooks of a form and character entirely unknown in these regions. In all the salmon streams which fall into the Gulf of Bothnia, not excepting the most northern, the Tornea and Kemi, it is quite common to find such hooks. They are found every summer, even in the Kymmene River, which empties into the Gulf of Finland, although not so frequently as in some of the other rivers. At the Raatti salmon fishery in the Ulea River, where all salmon are cleaned before they are sold, the fishermen gather every year a large number of strange hooks taken from the mouths and stomachs of salmon. Thus, I was informed during my last visit to Raatti in August, 1883, that among about 3,000 salmon caught since the end of June, weighing on an average from 25 to 30 pounds, there were at least 25 fish from which brass hooks were extracted. At the Klockarsand's government fisheries in the Kumo River, near Biorneborg, a considerable number of similar hooks are taken from salmon every summer.

With few exceptions, of which I shall speak later, the hooks found in salmon are of the same kind. They are made of brass wire, varying in thickness from 2 to 2½ millimeters [from one-twelfth to one-tenth of an

\* "*Laxens (Salmo salar L.) vandringari Östersjön.*" From *Aftryck ur Sporten*, No. 2, 1884. Translated from the Swedish by HERMAN JACOBSON.

inch], a little compressed at the bend of the hook, and varying in length from 9.5 to 11.5 centimeters. Most of them measure about 10.5 centimeters [ $4\frac{1}{8}$  inches] in length; and the opening of the hook has a breadth of from  $2\frac{1}{2}$  to  $3\frac{1}{2}$  centimeters [from 1 to  $1\frac{3}{8}$  inches]. To the hook there is frequently attached a piece of line, varying in length, generally still good, and measuring 1.5 to 1.8 millimeters [about one-sixteenth of an inch] in thickness. To this piece of line, if it is of sufficient length, there is generally attached a few inches from the hook a leaden weight of conical shape, bored through lengthwise, and weighing from 10 to 20 grams [about half an ounce]. Occasionally one or two letters or other marks are engraved on these weights. Fig. 3 shows such a brass hook with



its weight, taken from the stomach of a large salmon caught last July at the Muhos salmon fisheries in the Ulea River, about 4 miles from its mouth. On this weight the letters C and K can easily be distinguished on each side. Fig. 2 shows another hook of the same kind taken from a salmon near Uleaborg. All the hooks referred to as well as the weights are hand-made, and therefore vary somewhat in size and shape. The many hooks which have passed through my hands, and which had been

taken from salmon caught in the rivers Tornea, Kemi, Simo, Ijo, Haukipudas, Ulea, Sukajoki, Pyhäjoki, Kumo, and Kymmene, have all been of the same general type, and were evidently all intended for the same object.

As the question whence these characteristic and frequently occurring hooks and weights came is of great interest even from a practical point of view, I have given some time to its examination. The result of my researches show with a considerable degree of certainty that these hooks came to us from the north coast of Germany, where they are very generally used during winter for catching salmon. From statements by Professors Wittmack, Benecke, Möbius, and Heinicke, it appears that during the winter months, especially during March and April, very successful salmon fisheries with hooks and lines are carried on along the northern coast of Germany from Rugen to Memel, at a depth of from 30 to 60 meters [about 16 to 32 fathoms] and at a distance of from 10 to 30 kilometers [about 6 to 20 miles] from the shore. This method of catching salmon seems to have been very generally used from ancient times on the coast of Pomerania, where it is more common than in any other part of the German coast. According to Professor Benecke, however, it has during the last twelve years spread as far east as Memel, and possibly also to some parts of the Russian coast. The apparatus used in these fisheries resembles in all its leading features the salmon-line used on the coasts of Skane and Blekinge [Sweden], but the hooks and weights as well as the line are different from those employed in southern Sweden. Professor Benecke, of Königsberg, to whom I sent a brass hook taken from a salmon caught in the Ulea River, wrote me a letter entirely confirming the conclusion at which I had arrived, namely, that these hooks came from the coasts of Prussia and Pomerania. As they are not used in any other part of the coast of the Baltic or anywhere in the Baltic, it is evident that the salmon carry these hooks to Finland from the Prussian and Pomeranian coasts, where they are used in the salmon fisheries and where the fishermen annually lose a considerable number.

Occasionally large hooks of tinned iron or steel wire are found in salmon caught in Finland. These hooks are of an entirely different kind from the Pomeranian brass hooks, and the two in my possession do not at all resemble each other. The one taken from a salmon caught near Christinestad by Mr. Hasselblatt, and presented to me by Mr. H. O. Fontell, of Christinestad, resembles in shape, looks, and size the hooks which are used in winter for catching salmon in the open sea near Bornholm,\* and in the southeastern part of Skane and Blekinge. This hook is fastened to a conical leaden weight by means of a peculiarly constructed hemp line, measuring about 3.5 millimeters [about one-eighth

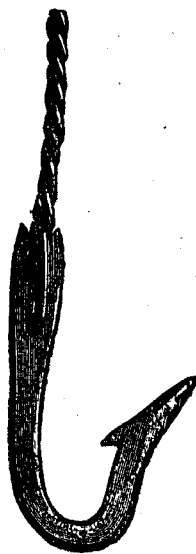
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\* Capt. Ivar Breunner, of Helsingfors, has had the kindness to send me, for the purpose of comparison, two salmon hooks, with line and weight, brought by him from Bornholm. These hooks, even to the smallest detail, are the exact counterparts of the hook from Christinestad.

of an inch] in thickness, and is nearly 9 centimeters [ $3\frac{1}{2}$  inches] long, the opening measuring 3.5 centimeters [ $1\frac{1}{2}$  inches]. The hook, weight, and line so exactly resemble the apparatus of this kind used near Bornholm and in southeastern Skane for catching salmon, that there can be hardly any doubt that these hooks came from Bornholm and southern Sweden. The other iron hook, which was taken from a salmon caught in the Kumo River, and a sketch of which is given in Fig. 1, also greatly resembles the Skane salmon hook, but is somewhat



*Fig. 1.*



*Fig. 4.*

longer, measuring 11.5 centimeters [ $4\frac{1}{2}$  inches], and is made of somewhat thicker wire. The end of a thick and strong hemp line, which is still attached to the hook, shows that the line was of the same kind as those used in salmon fishing near Bornholm, in Skane and Blekinge; and it is therefore tolerably certain that this hook likewise comes from the same region of the southern Baltic. The fact that these iron hooks are but rarely taken from salmon caught in our streams is probably owing

to the circumstance that the Scandinavians use much stronger lines for salmon fishing than the Germans.

Besides the above-mentioned hooks taken from salmon which are unknown in Finland, I have recently received from H. O. Fontell, of Christinestad, a hook made of thick, flattened brass wire taken from a salmon caught in the sea near Christinestad by Mr. Hasselblatt. This hook is about 4 centimeters [ $1\frac{1}{2}$  inches] long, of a very peculiar shape, and is firmly attached to a double brass wire 40 centimeters [ $15\frac{3}{4}$  inches] long and almost 1 centimeter [two-fifths of an inch] thick, which passes through two holes in the hook. I do not feel positive as to whence this strange hook may have come, but I suppose that it must have come from the Russian shore of the Baltic. To give a better idea of this hook I have sketched it in Fig. 4.

Dr. Rudolf Lundberg describes the hook and line fisheries for salmon which are carried on on the southeastern coast of Skane as follows:\*

"Fishing with salmon lines begins in autumn after the close of the herring fisheries, and is continued all through the winter whenever the weather permits. These lines are constructed in such a manner as to float on the surface and are fastened only at one end, the other being free, so it can float with the current. The part which keeps the apparatus in its place is called the 'string,' and is anchored at the bottom by means of a large stone. After the stone has been sunk, about a fathom of the string is hauled up, and a glass float is fastened to the string. Eight to twelve fathoms above this another glass float is fastened, and from 4 to 6 feet below this the line is fastened to the string. The line is kept floating near the surface by means of four wooden or cork floats. At present only three hooks are used (formerly five or six were used) on each line, whose length is 30 fathoms. The hooks, made of tinned iron wire, are tolerably strong (8 centimeters [3 inches] long and almost 4 centimeters [ $1\frac{1}{2}$  inches] across the opening), and are baited with herring which are cut just below the anal aperture, and are attached to the hook in such a manner that its point passes through the eye, and sticks out at the side. The salmon lines are set, one after the other, at such intervals that they may not become entangled when swayed to and fro by the current. The glass float before referred to keeps the string up in the water and prevents its being carried about by the current. This apparatus is set at a depth of from 20 to 30 fathoms, the farther from the shore the better. As long as the water is still warm in autumn, fresh bait should be put on the hooks every day. When the water gets colder,

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\* The German method of catching salmon with lines resembles (to judge from Professor Benecke's description) very much the Swedish method; but the Germans seem to use only one hook for every line, while the Swedes use three. It is said that the Germans use as bait, besides herring, also roach and *Cyprinus vimba*; and there are frequent complaints that the hooks are lost. The salmon are also frequently devoured by seals, which leave only the head.

the herring will keep three or four days without turning sour; if the bait becomes stale the salmon will not bite. During the autumn salmon fisheries there are four men in a boat with from 40 to 60 salmon lines."

The occurrence of strange hooks in salmon caught in the rivers emptying into the Gulf of Bothnia, both in Sweden and Finland, was mentioned a century and a half ago. Thus Nils Gisler says in the "Transactions of the Swedish Academy of Sciences" for 1752, p. 99: "In the Angermann River there are annually caught many salmon from which large hooks are taken, some of steel and others of brass. Some of these hooks have pieces of line attached to them in a good state of preservation, some of them measuring 2 fathoms in length, with leaden weights sometimes resembling in their shape church bells, with letters, names, and places of residence marked thereon. In the Njurunda River two hooks were taken from salmon in 1728, which in their shape differ greatly from other hooks. Such hooks are not often found in this river, as the large sea salmon do not often enter it, unless there is very high water, as was the case in the year referred to above. The hooks found in the other rivers are generally all of one and the same kind. Specimens of hooks taken from salmon in different places have been sent to the Royal Academy of Sciences. I do not know whether they are found in all kinds and varieties of the sea salmon and in the lake salmon and salmon trout. Sometimes hooks have been taken from salmon which had been caught far up the streams; thus one was taken in 1746 from a salmon caught 6 miles up the Lulea River. \* \* \* Here, in Norrbotten, such hooks are not used."

From time immemorial salmon-fisheries with hooks and lines have been carried on during the winter near the coasts of Bornholm. The apparatus used is very much like the one used in Skane, and the salmon-fisheries, especially net-fisheries, are said to have increased very much in these waters during the last ten years. It is specially reported that the number of small salmon and young salmon, weighing from 1 to 3 pounds each, has increased greatly since 1874, when these fisheries were comparatively small. The number of salmon-nets, which in 1874 was small, amounted in 1880 to upwards of 6,000. On the Baltic coast of North Germany the salmon-fisheries, both with hooks and lines and with nets, have considerably increased of late years, and the number of young salmon, weighing from 1 to 3 pounds, has particularly increased. The firm of M. Radmann & Son, of Berlin, report that last year 40,000 young salmon, weighing on an average  $1\frac{1}{4}$  pounds, were brought to Berlin from the coast of Pomerania.

The comparatively frequent occurrence in the salmon caught in our rivers and on our coasts of brass hooks like those used on the coast of North Germany proves, beyond a doubt, that many of the salmon, after having visited the coast of North Germany, return to our waters. Others have, during their migration to the Gulf of Bothnia, visited Bornholm

and the southeast coast of Sweden, as the iron hooks used in those localities and taken from salmon caught in Finnish waters prove conclusively. Since it is well known that the salmon as a rule return, for the purpose of spawning, to the rivers which they left as young fry, we are justified in supposing that the largely increased number of salmon and young salmon which during recent years have visited the coasts of Bornholm, Pomerania, and Prussia, are principally, and perhaps exclusively, fish which have been hatched in the salmon rivers of Finland and Northern Sweden. It is only about twelve or fourteen years that the salmon have been protected in the Finnish rivers, and during this period the salmon-fisheries in the Southern Baltic have increased and improved to a very noticeable degree. But if Finland (and also Sweden) is to enjoy, to a greater degree than has hitherto been the case, the fruits of protecting the salmon in the rivers of Finland during the spawning period, the catching of young salmon near Bornholm and on the coasts of North Germany ought to be stopped as soon as possible. This object would be greatly furthered if some international arrangement on this subject could be arrived at between all the Baltic States.

By marking salmon it has been found in England and Scotland that the various kinds of salmon during their stay in the sea prefer to visit certain portions of the coast in order to seek their food. Thus, according to Frank Buckland, the coast of Norfolk, especially near Yarmouth, is said to be the favorite place of the bull-trout [*Salmo eriox*], which is found in large numbers in some of the English and Scotch rivers. David Milne-Horne, who possesses the most thorough knowledge of everything relating to the salmon-fisheries in Scotland, and more especially in the river Tweed, states, as an instance of how soon a fish of the salmon kind can change its feeding-ground, that a bull-trout which, on March 29, 1852, had been marked in the Tweed with a silver thread bearing an inscription, was caught near Yarmouth on April 2, of the same year, after having traveled almost 300 miles in four days. Another fish was marked in the Tweed on March 10, 1880, and was caught near Yarmouth on May 5, 1880, after a journey of fifty-five days. As the salmon (*Salmo salar*), according to the experience gained in Scotland, is said, during its visits to the sea in seeking food, to prefer places where there is a sandy bottom, and as on the German coast between Memel and Rugen, near Bornholm, and on the southeastern coast of Sweden, the bottom of the sea is sandy, and as all the other conditions for a successful production of salmon food are found there, the cause of the regular visits of our salmon to these coasts must be found in these circumstances. The regular migrations which the salmon undertake in spring to the rivers emptying into the Gulf of Bothnia and the Gulf of Finland are made exclusively for the purpose of spawning.

HELSINGFORS, FINLAND, RUSSIA, February 6, 1884.